Fast Tracking using GenFit and PHG4Hit

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Fast tracking with Kalman Filter + pseudo pattern recognition

Motivation:

- Developed for fsPHENIX. Quickly produce tracking performance with Geant simulation + Kalman Filter. Could be a complete tracking code with real pattern recognition component.
- Jin suggest to generalize this to any detector setups.

Procedure:

- Simulation
  - $\Longrightarrow$ PHG4TruthInfoContainer.
  - $\Longrightarrow$ PHG4Hit.
  - $\Longrightarrow$ TGeo detector geometry in DST run node (PHGeometry by Jin)

- Feed the Kalman Filter:
  - PHG4Hit $\Longrightarrow$ Measurements: Smear PHG4Hit according to given detector resolution.
  - **Measurements grouping: use MC truth information, "pseudo pattern recognition"**
  - Seed: Smeared MC truth information

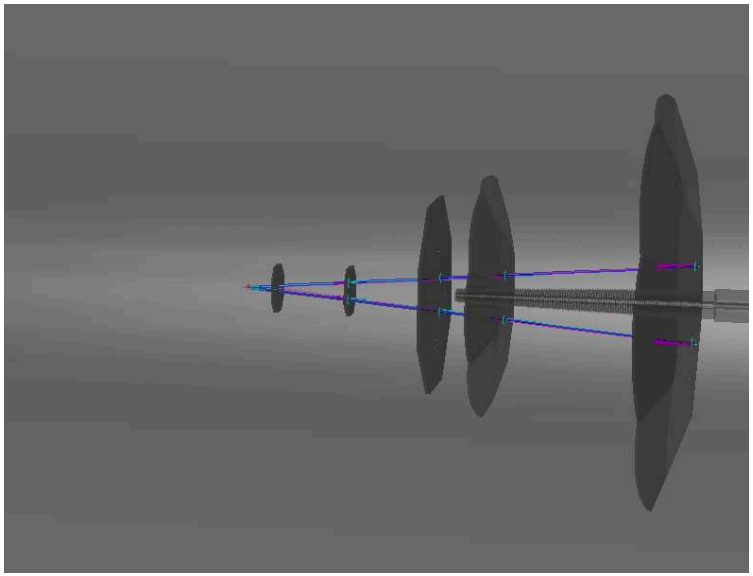
Implementation

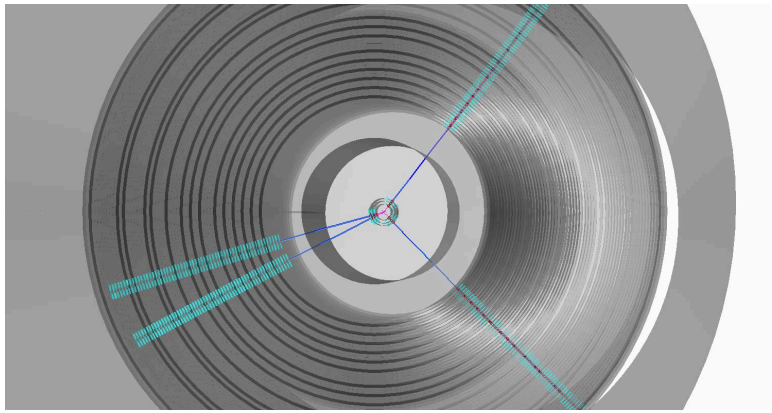
New version of *SvtxTrack*: *SvtxTrack_FastSim*. add two methods to *SvtxTrack*. Need this to do evaluation for multi-track events. Making the complete Track->Cluster->Cell->PHG4Hit chain is complicated and beyond the purpose of this code.

```
+  virtual unsigned int get_truth_track_id() const {return UINT_MAX;}
+  virtual void set_truth_track_id(unsigned int truthTrackId) {}
```

Relatively standalone tracking module, *PHG4TrackFastSim*:

- simulation/g4hough
- Took *PHG4TruthInfoContainer* and *PHG4HitsContainer* as input
- Output *SvtxTrackMap* with *SvtxTrack_FastSim* filled in.





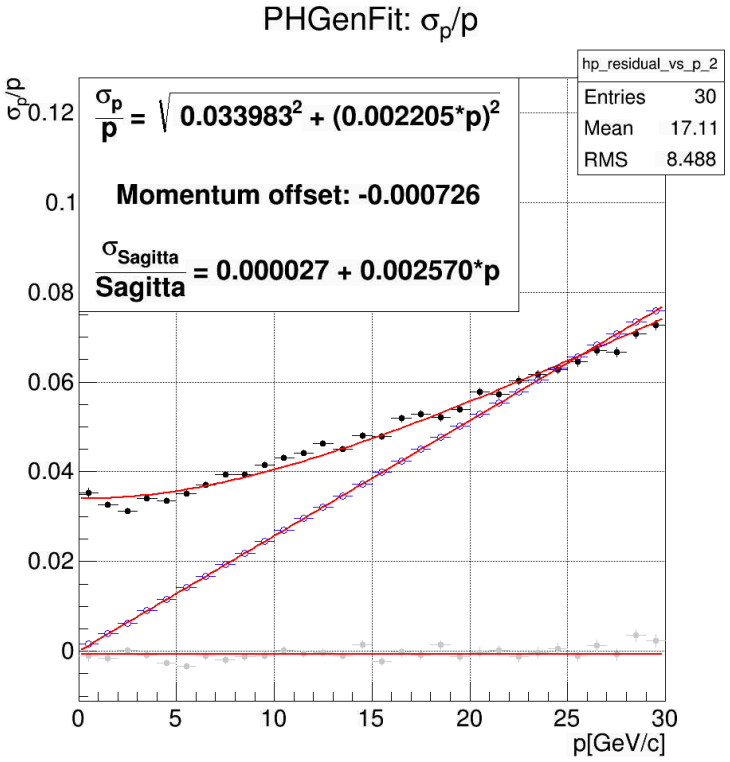
Switches

```
PHG4TrackFastSim* kalman = new PHG4TrackFastSim("PHG4TrackFastSim");
kalman->Verbosity(0);
kalman->set_use_vertex_in_fitting(true);
kalman->set_detector_type(PHG4TrackFastSim::Vertical_Plane); // Vertical_Plane, Cylinder
kalman->set_phi_resolution(50E-4);
kalman->set_r_resolution(1.);
kalman->set_mag_field_file_name("fieldmap.root");
kalman->set_mag_field_re_scaling_factor(1.);
kalman->set_pat_rec_hit_finding_eff(1.);
kalman->set_pat_rec_nosise_prob(0.);
kalman->set_do_evt_display(false);

std::string phg4hits_names[] = {"G4HIT_FGEM_0","G4HIT_FGEM_1","G4HIT_FGEM_2","G4HIT_FGEM_3","G4HIT_FGEM_4"};
kalman->set_phg4hits_names(phg4hits_names, 5);
kalman->set_sub_top_node_name("SVTX");
kalman->set_trackmap_out_name("SvtxTrackMap");
```

Comparing with previous standalone code

Standalone program



This module

σ_p/p